Intestinal Obstruction

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SUMMARY

Despite improvements in knowledge of the pathologic physiology of intestinal obstruction, the introduction of gastrointestinal decompression, and more effective antibiotics, obstruction remains a serious disease with a high mortality rate. Although the diagnosis is often obscure, it can usually be made with a fair degree of accuracy by the history alone; pain is fairly constant and characteristically is of a cramping type simulated by very few other lesions. Distention is present in low lesions but absent in high lesions; on the contrary, vomiting is minimal in low lesions but prominent in high lesions. Visible peristaltic waves are almost pathognomonic of intestinal obstruction. Increased peristaltic sounds, as noted by auscultation, are extremely helpful in diagnosis; they are absent in paralytic ileus.

Although intestinal obstruction is a surgical lesion, it must be remembered that in the type produced by adhesions the obstruction can be relieved by gastrointestinal decompression in 80 to 90 per cent of cases. Operation is usually indicated a short time after relief because of the probability of recurrence. In practically all other types of obstruction decompression is indicated only while the patient is being prepared for operation. Obviously any type of strangulation demands early operation. Strangulation can usually be diagnosed, particularly if it develops while the patient is under observation. Increase in pain, muscle spasm and pulse rate are important indications of development of strangulation.

Dehydration and electrolytic imbalance are produced almost universally in high obstruction. Usually, it is unwise to wait until these two deficiencies are corrected before operation is undertaken, but correction must be well under way at the time of operation. Resections should be avoided in the presence of intestinal obstruction, but obviously will be necessary in strangulation. Operative technique must be expert and carried out with minimal trauma. Postoperative care is very important; important features are decompression, for two to three days, accurate fluid and electrolytic replacement, and transfusions.

THE medical profession has always realized that intestinal obstruction is a serious disease carrying with it a high mortality rate. Fortunately, the mortality rate has decreased sharply during the past several years. Much of this improvement in results has been related to intelligent use of intestinal decompression. It must be emphasized, however, that unless decompression is utilized intelligently, the mortality rate may actually be increased. Although there are two types of obstruction, namely mechanical and functional, the material in this presentation will be confined largely to the former type. Surgeons, of course, realize the frequency of functional obstruction (for example, paralytic ileus) because it is so common after celiotomy. It is likewise encountered in abdominal trauma and notoriously develops after retroperitoneal injury.

The incidence of the various types of obstruction varies considerably in different reports, depending largely upon the percentage of patients derived from an emergency service; for example, in a city hospital where the percentage of emergency cases is high, the incidence of strangulated hernia will be high, whereas in private hospitals, where a relatively small number of emergency cases are received and where the number of patients admitted for operation is high, the incidence of obstruction due to adhesions will be high. A summary of numerous reports in the literature is given in Table 1.

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DIAGNOSIS

If the patient is questioned carefully regarding certain points in the history, the diagnosis of intestinal obstruction can usually be made within a few

TABLE 1.—*Incidence of Types of Obstruction* (summarized from the literature).

	Per Cent
Strangulated external hernia	33
Obstruction due to adhesions (¾ are postoperative)	32
Obstruction due to neoplasm	15
Intussusception	8
Volvulus	3
Internal hernia	2
Foreign body (gallstones, etc.)	1
Miscellaneous causes (congenital anomaly, mesentery thrombosis, etc.)	6

minutes. The most important diagnostic aid lies in the type of pain. With few exceptions, the pain of intestinal obstruction starts out as a true cramp which is mimicked by few other diseases. In other words, the cramp develops for a minute or two and gradually disappears, remaining absent for a variable length of time, perhaps one to five minutes. Commonly a moderate amount of mild diffuse pain remains between cramps. This is particularly true if the obstruction has been present for a considerable time, and when strangulation is present.

Examination of the abdomen is usually very helpful, as an intestinal pattern and peristaltic waves will almost always be demonstrable unless the abdominal wall is very obese. If the distention is severe, the abdominal wall may be tense, but muscle spasm is absent unless strangulation is present. Vital information can be obtained by auscultation of the abdomen. Almost always there will be increased sounds unless peritonitis is present. However, since the intestinal sounds are not constant but manifested only during peristaltic waves, it is usually necessary to listen for three to four minutes before an accurate assay can be made as to the amount of accentuation.

On numerous occasions, particularly in the postoperative care of patients, it will be extremely difficult to differentiate between postoperative ileus and mechanical obstruction. However, in the former complication pain is minimal and peristaltic sounds either absent or minimal; likewise peristaltic waves are not seen in postoperative ileus. Differential diagnosis may be extremely difficult if the mechanical obstruction is complete, in which case distention would be minimal and pain variable. X-ray examination is of extreme aid in diagnosing intestinal obstruction. However, with few exceptions the examination must be limited to a plain film of the abdomen or to films with barium enema; ordinarily, barium by mouth is strongly contraindicated unless it is known that the obstruction is in the pylorus or duodenum and the barium can be aspirated immediately after the examination is completed. A variable amount of fluid is found in the free peritoneal cavity. In the absence of strangulation it is clear and relatively scanty. It has a high protein content similar to that of blood plasma.

Symptoms of shock may develop late in intestinal obstruction. They are related to the loss of fluid which may be as great as 5 to 6 per cent of the body weight. Occasionally the shock is related to the development of strangulation of a large loop of intestine; in this instance a large amount of blood along with fluid would be trapped within a very short time, thereby reducing the blood volume rather abruptly. When perforation through a gangrenous area takes place, shock is likewise common. In these circumstances it is due largely to the absorption of toxic products escaping into the free peritoneal cavity.

High Intestinal Obstruction. Although pain is the first symptom of intestinal obstruction, nausea and vomiting develop early if the obstruction is high, that is, above the ileocecal valve. When the obstruction is located in the duodenum, distention may be minimal because only the stomach is involved. However, on rare occasions when chronic obstruction of the duodenum is present the stomach becomes so dilated as to completely fill the abdomen when filled with gas and fluid. When the obstruction is located lower in the small intestine, a variable amount of distention will develop, depending largely upon the amount of vomiting. Constipation is of course a symptom of intestinal obstruction, but when it is located high it should be emphasized that the patient may have one or two bowel movements several hours after the development of obstruction because the portion of the intestinal tract distal to the obstruction can be emptied as usual.

Dehydration and hypochloremia develop in high intestinal obstruction at a rate depending largely upon the amount of vomiting. Dehydration naturally results in diminished blood volume and decrease in urinary output, which in turn results in elevation of the non-protein nitrogen level. The diminished blood volume is accentuated by the loss of plasma through the lumen and wall of the intestine.

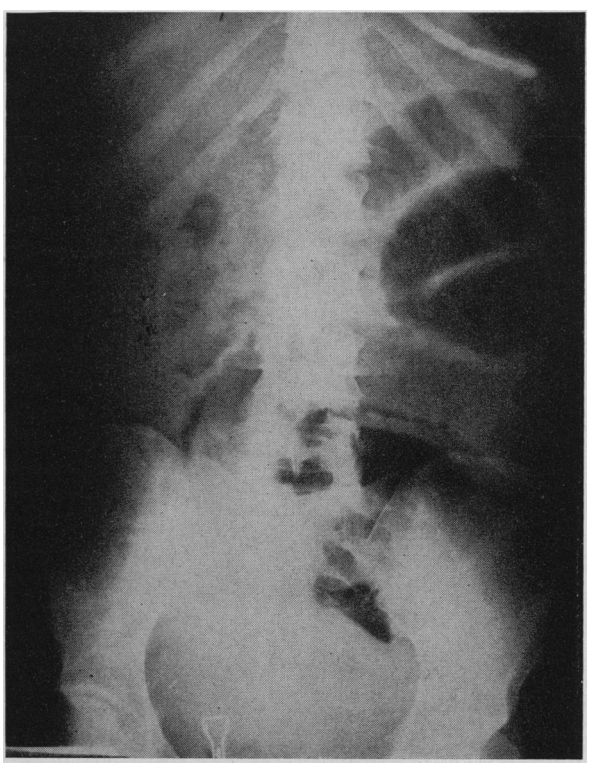

Figure 1.—Plain film of abdomen reveals distended loop of intestine with a "herringbone" pattern typical for small intestine. The patient, aged 30, had a cesarean section 12 days previously and had abdominal pain with nausea and vomiting for two days prior to admission. Decompression was effective; the tube was removed in 24 hours and feedings begun. Obstruction recurred and operation was performed. An adhesion at the suture line was found obstructing a loop of mid-ileum. Decompression longer than 24 hours might have resulted in relief lasting at least for several days, thus allowing restoration of the physical condition to normal. Operation could then have been performed in an interval phase when the operative risk was optimum.

X-ray studies are of great value in the diagnosis of high intestinal obstruction. When the obstruction is proximal to the ileocecal valve loops of the small bowel will be distended but there will be no distention of the large bowel. Distention of the small bowel is associated with a rather typical herringbone pattern on the x-ray film (see Figure 1). Fluid levels are likewise usually observed.

Low Intestinal Obstruction. In low intestinal obstruction the pathologic changes differ from those in high intestinal obstruction, largely because vomiting is minimal or even absent. It is not uncommon for a patient to have low obstruction for a period as long as four to five days and with a history of having vomited only once or twice during that period. However, the dehydration still develops with a variable amount of hypochloremia due largely to lack of intake of water and food. Distention itself is an extremely dangerous complication of obstruction. It may actually cause gangrene although gangrene is usually caused by compression of vessels by a hernial ring or other mechanical process. When compression is applied to the wall of the intestine, whether it is produced by an extrinsic mass or gaseous distention, the veins will be obstructed before the arteries, primarily because they are more collapsible and usually located in a more superficial position. Obstruction of the veins permits the accumulation of fluid in the wall of the intestine and in the lumen because of transudation. Sperling has shown in experimental studies that gangrene can be produced if a pressure of 20 cm. of water is maintained in the lumen of the intestine for a period of 24 hours. Most patients with low intestinal obstruction appear quite ill, and notoriously tolerate operation poorly. This debilitation is no doubt related in some way to the extreme distention, but the exact mechanism is unknown, unless the anoxia in the bowel wall produced by the distention gives rise to toxic products in the wall of the intestine itself.

Constipation will of course be a prominent feature in low intestinal obstruction; rarely will there be a bowel movement after complete obstruction develops. Occasionally bloody discharge in the rectum may be noted and it may be expelled. However, this is so uncommon as to be of little value diagnostically except in infancy when conditions such as intussusception are associated with bloody discharge. As in high intestinal obstruction, a plain x-ray film will be very helpful in diagnosis. If the obstruction is limited to the left side of the colon, considerable large bowel distention may be observed (see Figure 2). Obstruction is quite infrequent in carcinoma of the right colon, but is common in carcinoma of the transverse colon. When there is considerable doubt in the diagnosis, a barium enema is permissible to establish diagnosis, although the barium should be removed by a rectal tube and the bowel irrigated after the x-ray examination. If barium is forced under pressure past an obstruc-

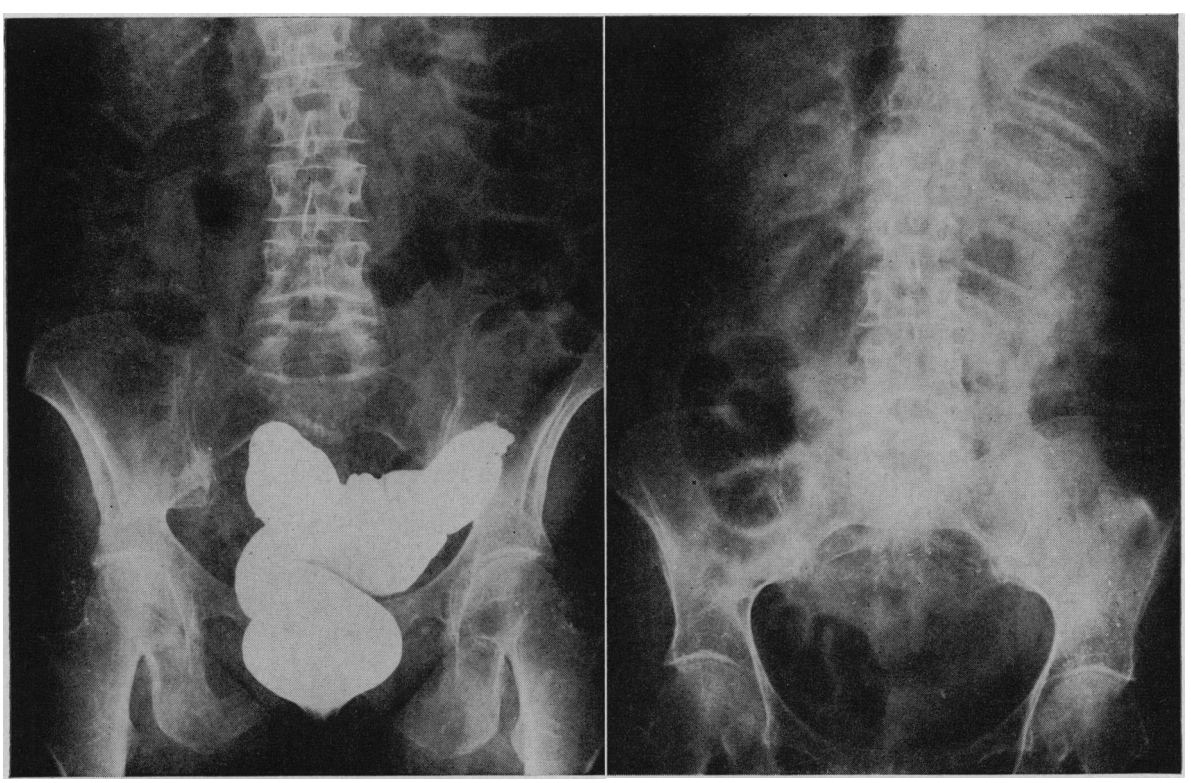

Figure 2.—*Left:* Plain film of the abdomen in a patient, aged 58, with evidence of complete intestinal obstruction for three days but with a history of having vomited only once. Distention was pronounced. Note the distended loop with haustral markings typical for large bowel. *Right:* Same patient. Barium enema revealed an obstruction in the sigmoid colon. A diagnosis of carcinoma was obvious.

tion, it may be retained for a considerable time and greatly complicate surgical treatment (see Figure 3).

DIAGNOSIS OF STRANGULATION

Although it is usually quite difficult to diagnose strangulation in patients who are admitted in emergencies, it can usually be detected when it develops in patients who have been under observation for several hours. It is so important to determine the presence of strangulation as soon after development as possible that the manifestations are listed below in some detail.

1. An *increase in the amount of pain* is one of the most valuable indications of the development of strangulation. This is particularly true when the pain is superimposed on the abdominal cramps. Notoriously the pain of strangulation is much more severe than that of simple obstruction; it may be so severe that the patient pleads for narcosis.

2. An *increase in abdominal tenderness* invariably develops along with the increase in pain. It is usually but not invariably located at the site of pain.

3. An *increase in pulse rate* is almost always found when strangulation develops. It is due in part to the development of pain but is accentuated by the loss of blood through the strangulated loop.

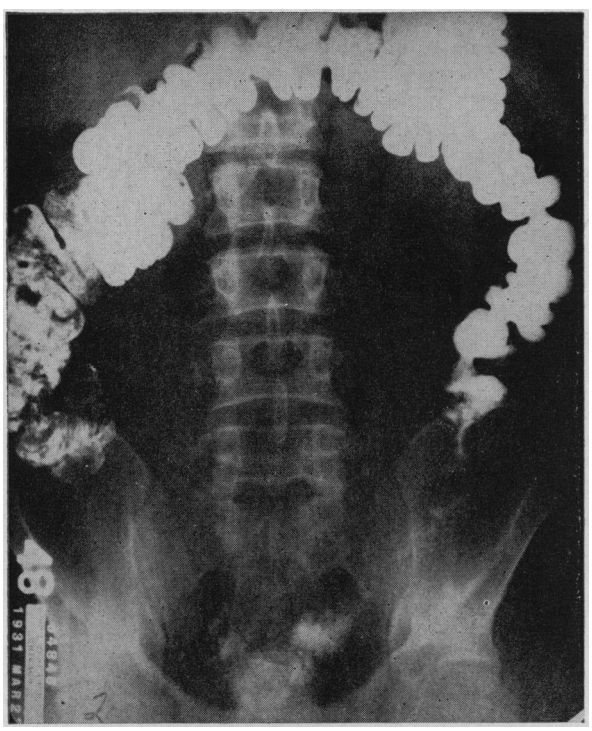

Figure 3.—The patient had a history of cramping pain and alternate attacks of constipation and diarrhea. Distention was present at intervals. A diagnosis of partial obstruction of the large bowel, due probably to carcinoma, was made. A barium enema revealed a constricting lesion in the sigmoid colon; under moderate pressure the barium passed the obstruction and filled the rest of the large bowel. The film shown above was taken 48 hours after the barium enema and after evaluation along with a soapsuds enema. Note the pronounced retention of barium proximal to the obstruction. This complication will usually prevent consideration of resection with primary end-to-end anastomosis, because the desiccated masses of barium can usually not be washed out with enema or colonic irrigations.

4. The development of a *mass* strongly suggests the presence of a strangulated loop which becomes so distended as to appear firm to palpation. Obviously the mass will not be palpable if the strangulation involves merely a small area of intestine such as that produced by an adhesive band.

5. The development of *muscle spasm* in simple strangulation is somewhat variable but usually is present to a slight degree soon after the strangulation develops. The amount of intestine strangulated may exert a slight influence on the development of muscle spasm but by no means is the amount of spasm dependent upon the amount of intestine involved in the strangulation. A most important factor in the development of muscle spasm is perforation through the gangrenous wall.

6. *Leukocytosis* usually develops comparatively early in strangulation. The number of leukocytes per cubic millimeter may be no greater than 10,000 to 14,000 until peritonitis develops, when it may rise sharply to 25,000 or 30,000.

7. A *sudden fall in blood pressure* is sometimes indicative of the development of strangulation in a long loop of intestine which may have been obstructed for several hours preceding the strangulation. It may also indicate perforation, since it is encountered in other lesions such as hemorrhage. Fall in blood pressure alone is not diagnostic of strangulation. It is, nevertheless, a sign of serious complication, and usually indicates that surgical treatment is urgently needed. Fever is usually present in strangulation although it may also be produced by dehydration. However, the temperature is rarely very much elevated unless peritonitis is present.

The physician must not wait for all of the manifestations listed before diagnosing strangulation. As a matter of fact, when fever or leukocytosis develops, peritonitis is commonly already present, and the patient is liable to die regardless of the type of therapy instituted. Perhaps the earliest signs of strangulation are increase in pain and increase in pulse rate. When these two symptoms develop, the possibility of strangulation must be considered. If there is any doubt about the possibility of strangulation while the patient is undergoing conservative treatment, it is usually advisable to resort to celiotomy rather than to wait until the manifestations are obvious (see Table 2).

TABLE 2.—*Contraindication for Continuation of Nasal Suction in Intestinal Obstruction.*

1. Increase in abdominal pain.
2. Increase in abdominal tenderness.
3. Increase in pulse rate.
4. Development of a mass.
5. Development of muscle spasm.
6. Failure to obtain relief of distention.
7. Leukocytosis.
8. Fever.
9. Sudden fall in blood pressure.

TREATMENT

Decompression. The treatment of intestinal obstruction is dependent upon the type of obstruction. With the utilization of the principle of decompression advocated by Wangensteen, almost all types of obstruction now can be much more intelligently treated. As a matter of fact, obstruction due to adhesions can be completely relieved in 80 to 90 per cent of cases, but only if decompression is utilized intelligently. Decompression is likewise very effective in functional ileus; operation is obviously contraindicated in obstruction of this type.

Accordingly, decompression can be utilized as a definitive method of treatment in functional ileus and obstruction due to adhesions. However, it is very seldom effective in such lesions as carcinoma of the colon, volvulus, intussusception, extrinsic mass, and stricture. It is obvious that some of the latter named lesions, including intussusception and volvulus, must be treated by emergency operation as soon as the patient's condition can be brought to that of reasonable operative risk. However, in obstruction of that type, where immediate operation is mandatory, decompression should be instituted as soon as the patient is admitted to the hospital so that the stomach and upper jejunum may be evacuated, thereby facilitating anesthesia as well as reduction of distention. Moreover, early decompression will prevent further development of distention by removing all swallowed air.

Therefore, it is always good therapy to institute decompression immediately after admission to the hospital even though the exact type of obstruction is still unknown. Opinions differ as to the type of tube to be utilized in decompression. In general there are three types (see Figure 4). The Miller-Abbott tube, the Harris tube and the Cantor tube are actually superior to the Levine tube placed in the stomach because decompression can be achieved down to the point of obstruction. Unfortunately it is sometimes very difficult to pass the tube beyond the duodenum. It is true that the Harris tube, weighted with mercury at the tip, is usually passed more easily than the Miller-Abbott tube. An added advantage of the Harris tube is that it has a large lumen. This minimizes blocking of the tube with food particles—a serious complication which if not appreciated can defeat the value of decompression. Often it may be desirable to insert a large stomach tube to wash out all food particles from the stomach and then insert a smaller tube for decompression. Even so, it is essential that the decompression apparatus be inspected frequently during therapy to be sure that decompression is being carried out.

As previously indicated, decompression therapy can be considered as definitive treatment when the obstruction is due to adhesions. After good decompression is obtained, the obstruction may be relieved, although the tube must not be removed too early. In general it is rare to obtain significant relief of obstruction in less than two or three days. Accordingly, the tube must be kept in for at least that long even though it may appear obstruction has been relieved. After it is obvious that obstruction has been relieved, the tube can be removed and the patient permitted to take water by mouth. Liquids and soft diet can be given thereafter, but only in small, gradually increased amounts. Although decompression may relieve the obstruction, it is liable to recur when the patient resumes a normal diet. This recurrence is so common that it is usually advisable to operate for correction of obstruction during the interval of relief.

Operative Treatment. Careful judgment must be exercised in determining the time for operation in intestinal obstruction. As previously noted, in many cases in which the obstruction is produced by adhesions it will be relieved by decompression alone. However, on most occasions it will be necessary to operate after food intake has been resumed because obstruction is so liable to recur.

Except in paralytic ileus and obstruction due to adhesions, operation will be necessary as soon as the patient is in condition to withstand the procedure. Even though strangulation of the intestine is obvious, it is always necessary to correct such decrements as dehydration and loss of electrolytes. Although the usual rate of introduction of intravenous fluid is 500 cc. per hour, this rate may be increased greatly in the presence of dehydration, unless there is a history of cardiac disease. Accordingly it may require four to six hours to improve the patient's condition to the point where he will tolerate the operation with moderate safety.

There are no accurate rules regarding the amount of fluid and electrolyte to give the patient with obstruction, but certain general principles are agreed upon. For example, when dehydration is present, fluids are given rapidly and the urinary output measured every few hours. Until the urinary output is equivalent to at least 50 cc. per hour, it may be assumed that dehydration still exists. The solution usually used to overcome dehydration is 5 per cent glucose with normal saline solution. However, it must be emphasized that once the electrolyte deficiency has been corrected, administration of saline solution in the immediate postoperative period should be carried out cautiously, particularly in patients whose kidneys are perhaps damaged by arteriosclerosis or other disease. Coller's formula, which states that 0.5 gm. of sodium chloride per kilogram of body weight may be administered for each 100 mg. of chloride deficiency per 100 cc. of plasma, can be used, but with caution. Only in young individuals with normal kidneys can this formula be used with safety. It should be emphasized that in elderly people whose kidneys are functioning below normal, it is unsafe to give the amount of salt called for in the formula, particularly if operation is to be carried out immediately, lest salt retention cause oliguria or anuria postoperatively.

Many patients with intestinal obstruction will need a transfusion of blood before or during the operation. Determination of hemoglobin value, packed red cell volume and erythrocyte count at the

time of admission of the patient will yield misleading data; because of dehydration and reduced plasma volume, the values will be relatively high. Accordingly these determinations must be repeated in three to four hours after hydration is carried out, in order to obtain information on the real status of the blood. If, for example, results of blood studies on admission are normal findings, or if results of examination of the blood drawn three to four hours later (before complete hydration has taken place) are slightly below normal, it may be assumed that the patient actually is anemic and should be given blood before as well as during operation.

Certain principles in the operative treatment must be recognized and respected. Manipulation of the intestine must be held to a minimum. If strangulation is present, superficial exploration of the abdomen will almost invariably reveal its location. Obviously, if a condition such as intussusception is present, superficial palpation will reveal a mass, thereby making further exploration unnecessary. In the absence of a mass or obvious location of the obstruction, it may be necessary to examine various loops of intestine. If decompression has been quite effective, there may not be significant dilation of the intestine proximal to the obstruction. However, in ordinary circumstances the surgeon may be guided by observation of dilated loops proximal to the obstruction and collapsed loops distal to the obstruction. Frequently, indeed, observation of such conditions will lead the surgeon rapidly to the point of obstruction.

In general, if there is active obstruction, resection should be avoided if possible, but obvious gangre-

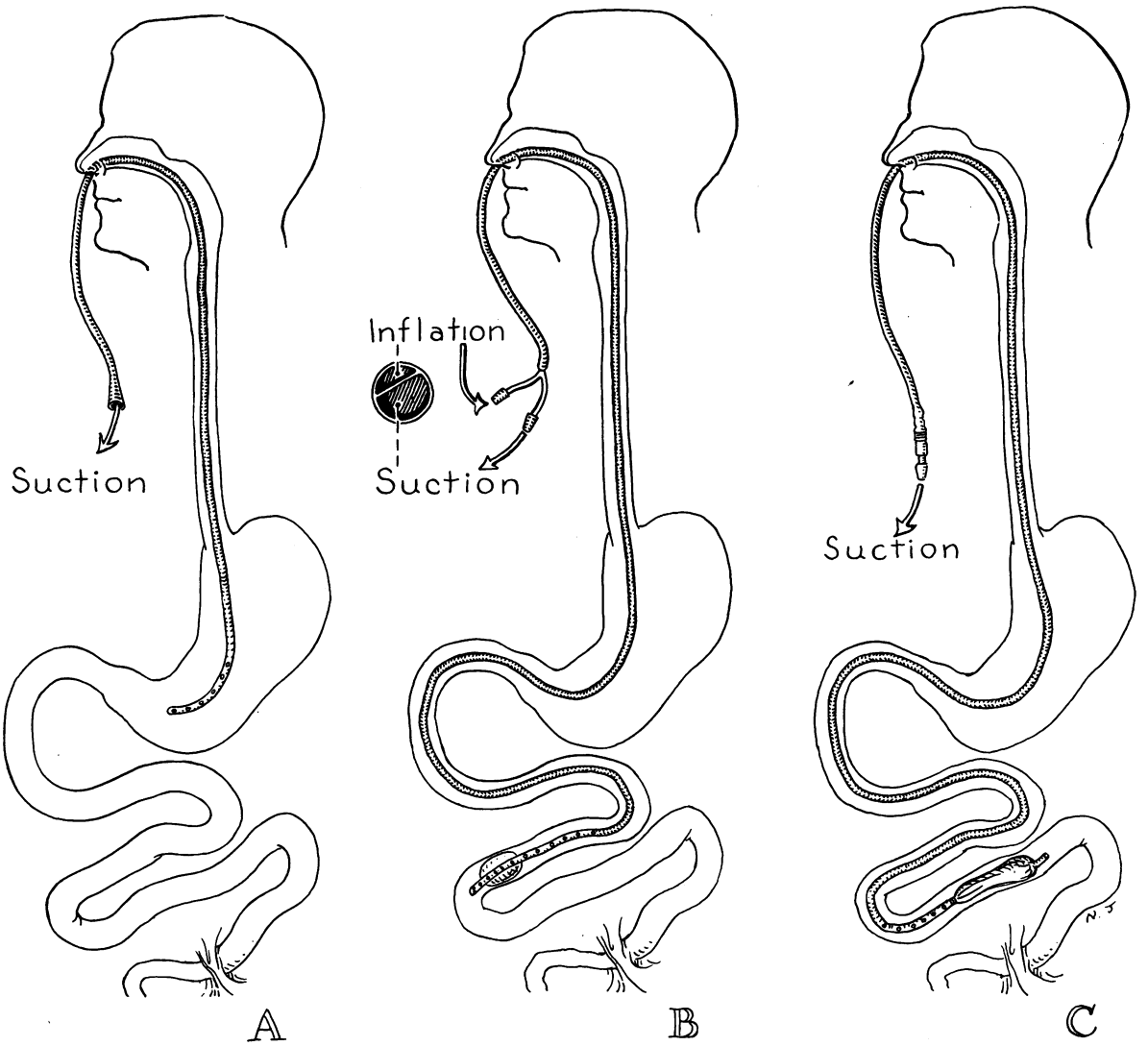

Figure 4.—Three types of tubes are available for gastrointestinal decompression: (a) Ordinary Levine tube inserted through the nose into the stomach. (b) The Miller-Abbott tube can be passed through the duodenum down to the point of obstruction. The tube contains two lumina as indicated by the insert. The balloon at the tip contains air. (c) The Harris tube can be passed down to the point of obstruction; it has an advantage over the Miller-Abbott tube because it has a large (only one) lumen for evacuation of fluid and food particles. The rubber balloon at the tip contains mercury (after Cole in Canadian Medical Association Journal).

nous loops of intestine or loops without viability cannot be returned to the peritoneal cavity. When resection is done, it will occasionally be life-saving to bring the strangulated loop outside the peritoneal cavity as an obstructive resection. The wound then may be closed around the two branches of the loop. This procedure is much more applicable to obstructed strangulated loops in the large bowel than to those in the small bowel because the postoperative loss of fluid and electrolyte from the small bowel is so much greater than from the large. (It should be noted in passing that resections can be carried out more boldly than in the past, provided adequate blood is given during and after operation.)

Another precaution which must be respected at all times is that anastomosis must not be carried out in an area where the intestine is edematous. In other words, the resection must be wide enough so that the anastomosis can be performed through relatively normal intestine.

POSTOPERATIVE TREATMENT

With very few exceptions, gastrointestinal decompression must be instituted after operation. If the Miller-Abbott tube or Levine tube was functioning before operation, it should be left in during and after operation. This will maintain decompression so that pressure of distention against a suture line will be prevented. How long to continue decompression after operation cannot be determined by a simple rule. However, with few exceptions, it must be maintained for 48 hours after resection and anastomosis have been carried out. After 48 hours, if a moderate amount of distention is present, perhaps because of inefficient decompression, it may be necessary to continue decompression for another day. Occasionally when the tube is removed and the patient is given fluids by mouth, distention reaccumulates. In such circumstances it may be necessary to replace the tube after 24 to 36 hours. Auscultation of the abdomen may help in determining when to remove a tube or to begin feedings: Once peristaltic sounds return to normal, food intake should ordinarily be tolerated satisfactorily unless obstruction exists.

As was intimated previously, the blood picture must be followed closely and transfusion carried out if the protein content or the erythrocyte count is below normal.

RESULTS

The mortality rate in intestinal obstruction before the institution of gastrointestinal decompression was as high as 35 per cent. It varied somewhat depending upon the number of strangulations in the respective series. At present the mortality rate is between 10 and 15 per cent for a large series of patients. This improvement is due largely to decompression, a more judicious use of blood, a better understanding of fluid and electrolyte balance, and the use of chemotherapeutic agents. Naturally, the duration of obstruction affects the mortality rate. For patients receiving care within 24 hours of the onset of symptoms, the mortality rate should be as low as 5 per cent.